Summary of Impacts to Aquatic Life in the Elk River Valley

Introduction

The following impacts are currently documented in the Elk River valley, British Columbia (B.C.):

1. Fish reproductive effects and mortality
2. Habitat loss
3. Stream alterations including stream dewatering
4. Loss of macroinvertebrate diversity and communities
5. Drinking water violations
6. Calcite deposition and cementing of stream bottoms
7. Violations of permit compliance limits

The causes of these impacts are varied and include:

1. Water quality pollution
2. Mining valley in-fill/ waste rock
3. Physical stream manipulation

The sources of pollution are:

1. Open pit coal mining at five sites in the Elk River valley
2. Timber harvest (minor)
3. Other anthropogenic activities (minor) (e.g., construction, other discharges, etc.)

Reproductive Effects and Fish Mortality

Lemly (2014)[1] documented impacts to fish populations in the Elk River valley and stated that,

> *All Indications are that selenium pollution is having a substantial negative impact on westslope cutthroat trout in the Upper Fording River system. In the samples collected and analyzed by Environment Canada in 2012 and 2014, and submitted to me for review, the waterborne selenium is present at concentrations far above levels that cause bioaccumulation in the aquatic food-chain and excess dietary selenium Intake by fish, and cause associated reproductive toxicity in fish (the fish toxic threshold, that is, the concentration at which sensitive species first begin to experience selenium poisoning in habitats favorable for bioaccumulation, is 1 µg/L; measured concentrations in the Upper Fording River system typically ranged from 5-113 µg/L).*
>
> *Based on the data provided in the Environment Canada 2012-2014 report, as well as the report "Early Life Stage Bioassay and Assessment of Larval Deformities in cutthroat trout (Oncorhynchus clarki lewis,) Exposed to Selenium at the Teck Fording River Operations and Greenhills Operations Mines in British Columbia's Elk Valley Region", Environment Canada and Dept. of Fisheries and Oceans, Freshwater Institute 2014, an estimate of the*

[1] Lemly. 2014. Expert Report – Review of Environment Canada's Teck Coal Environmental Assessment and Evaluation of Selenium Toxicology Tests on Westslope Cutthroat Trout in the Elk and Fording Rivers In Southeast British Columbia. September 25, 2014. Accessed on September 15, 2020 at [HYPERLINK "https://www.teck.com/media/2014-Water-review_environment_canada-T3.2.3.2.1.pdf"]

> *population mortality of westslope cutthroat trout in the Upper Fording River due to selenium poisoning was determined to be 54.4% of the annual reproductive output or 180,794 fish lost each year.*

Environment Canada (2014)[2] issued a similar report at the same time and stated that,

> *An early life stage bioassay of West Slope cutthroat trout was conducted in June-July 2012 utilizing fish from the coal mine affected Upper Fording River and a non-mine affected Connor Lake. After fertilization the eggs and emergent fry of Westslope Cutthroat trout containing organo selenium compounds exhibited increasing rates of deformities, abnormalities and mortality at selenium concentrations greater than 20 µg/g (parts per million) · dry weight and 100 percent mortality at concentrations greater than 57 µg/g dry weight selenium. For those eggs which did hatch, the embryonic trout containing organo selenium compounds exhibited increasing rates and degrees of cranial-facial and spinal deformities and increasing rates and degrees of edema (tissue swelling) that impaired feeding and swimming behavior. (Figure 1-4) This test demonstrated that the deposit of selenium from the Teck Fording River Operations and Greenhills Operation coal mines are deleterious to fish.*

There is anecdotal evidence of deformities in adult fish in the Elk River valley. The 2014 Environment Canada report[3] states that,

> *Environment Canada has received numerous reports of the incidence of deformities in sport caught fish in the Elk River and its tributaries. The most common report is shortening or absence of the operculum {gill cover).*

Teck reported major fish population declines in the upper Fording River, Harmer Creek, and Grave Creek watersheds in 2019[4] stating that,

> *As part of our planned monitoring, the results of the 2019 Westslope Cutthroat Trout fish counts were 74% lower for juveniles and 93% lower for adults than the 2017 counts in the Fording River upstream of Josephine Falls. Fish counts for juveniles were 96% lower in Harmer Creek and 25% lower in Grave Creek, while fish counts for adults were 26% lower in Harmer Creek and 25% higher in Grave Creek compared to 2018 counts. Harmer and Grave Creeks are located in watersheds adjacent to Teck's Line Creek and Elkview Operations and flow into the Elk River 4.5 km south of the confluence of the Elk and Fording Rivers.*

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[2] Environment Canada. 2014. Interim Expert Witness Report - Environmental Sampling in Areas affected by Coal Mining in the Elk and Fording River Watersheds of South Eastern British Columbia. 2012-2014. By Peter K. Krahn, P. Eng., Sr. Enforcement Engineer and National Operational Advisor, Environment Canada Enforcement Division, Pacific and Yukon Regional Office. Version Date: 2014-09-25. For Public Prosecution Service of Canada Regulatory and Environmental Crimes.

[3] Ibid

[4] Teck Resources Ltd. 2020. Water Quality in the Elk Valley [Online]. Accessed on September 15, 2020 at https://www.teck.com/responsibility/sustainability-topics/water/water-quality-in-the-elk-valley/

Teck has not identified a cause of the population collapse in the three watersheds although Westslope Fisheries (2020)[5] stated that,

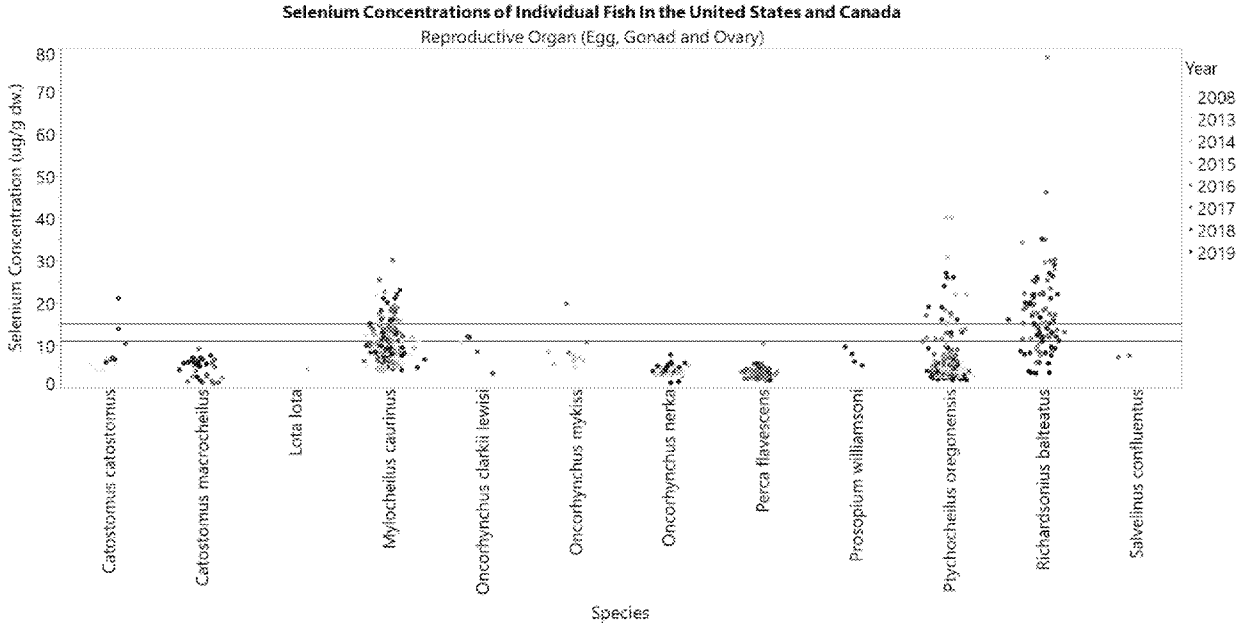
> *some feature or condition unique to the upper Fording River, which could include mine influences, are the cause for the population decline between 2017 and 2019; not the broader influence of regional climatic conditions*

In 2014, Teck's West Line Creek Active Water Treatment Facility at the Line Creek operations caused a fish kill in Line Creek. Teck (2017)[6] later stated that,

> *The fish mortality was believed to be related to levels of certain constituents including nitrite, ammonia, hydrogen sulfide and phosphorous unintentionally discharged into the water during commissioning of the facility, while low levels of oxygen in the receiving environment may have also been a factor.*

Forty-five fish were killed in the incident.

Multiple fish in Lake Koocanusa exceeded egg-ovary tissue thresholds that EPA and B.C. believe are protective for fish species (15.1 µg/g and 11.0 µg/g, respectively)[7].



[5] Westslope Fisheries. 2020. Upper Fording River Westslope Cutthroat Trout Population Monitoring Project: 2019. Accessed on September 17, 2020 at https://www.teck.com/media/UFR_WCT_Monitor_Final_Report_April_9_2020.pdf

[6] Teck Resources Ltd. 2017. News Release – Update Regarding 2014 Fish Mortality at Line Creek. Accessed on September 15, 2020 at https://www.teck.com/media/Teck-News-Release-Oct-5-2017.pdf

[7] Lotic Environmental. 2019. Koocanusa Reservoir Data Compilation Report – Version 2. Available at [HYPERLINK "http://lakekoocanusaconservation.pbworks.com/w/browse/" \l "view=ViewFolder&param=2019%20Master%20Lake%20K%20Data%20Compilation%20and%20Report%20by%20Lotic%20Env_ie_State%20of%20the%20Lake%20Report"].

The 2019 Environmental Monitoring Committee Report[8] summarized fish data for three species in the Elk River valley (westslope cutthroat trout, mountain whitefish, and dwarf longnose suckers):

> **Westslope Cutthroat Trout –** *Preliminary results from the September 2018 sampling events indicate that nearly all of the fish sampled had selenium concentrations near or above the upper limit of the normal range observed in reference-area fish.*
>
> **Mountain Whitefish –** *For fish collected at four of the six mine-influenced locations, the concentration of selenium in ovary tissue was above the interim screening value proposed by Teck (29.3 mg/ kg dw).*
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> **Dwarf Longnose Suckers –** *In the six mine-exposed areas sampled in 2015, the concentration of selenium was greater than for those fish collected from reference areas. The concentrations of selenium in ovary and muscle tissues were above the Level 1 benchmarks for reproductive effects for all individuals from Goddard Marsh, some of the fish from the Elk River wetland (downstream from Grave Creek), and some of the fish in Stanford Pond (near Fernie). The results from 2018 indicate that concentrations are increasing and Teck is discussing a selenium effects study on this species in the next few years.*

Habitat Loss

For the purpose of this summary, habitat loss is defined as stream habitat that is no longer accessible to fish either because of (1) valley infill/rock drains (e.g., streams that have been buried or removed due to mining activities) or (2) a barrier, culvert, or other anthropogenic structure blocks upstream passage.

Surprisingly, there is little published information about the total amount of habitat loss in the Elk River Valley due to mining activities. However, the upper Fording River has been extensively studied and a 2016[9] report states that,

> *roughly 59% to 79% (depending on whether or not one includes the multiplate and Henretta Creek partial barriers) of all historically available tributary habitat has been lost (i.e., infilled) or fragmented (i.e. isolated upstream of a fish passage barrier such as a culvert, in line settling pond of rock drain) from the mainstem upper Fording River population of Westslope Cutthroat Trout.*

Environment Canada (2014)[10] also documented extensive habitat loss in the upper Fording River stating,

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[8] Teck Resources Ltd. 2019. Permit 107517 Environmental Monitoring Committee 2019 Public Report. Accessed September 17, 2020 at https://www.teck.com/responsibility/sustainability-topics/water/water-quality-in-the-elk-valley/research-and-monitoring-reports/.

[9] Westslope Fisheries. 2016. Upper Fording River Westslope Cutthroat Trout Population Assessment and Telemetry Project Final Report Study Period: August 2012 to November 2015. Technical Report Overview prepared for Teck by Westslope Fisheries, Ltd. Accessed on September 15, 2020 at [HYPERLINK "https://www.teck.com/media/Upper-Fording-River-Westslope-Cutthroat-Trout-Population-Assessment-and-Telemetry-Project,-Final-Report-(December-2016).pdf"].

[10] Environment Canada. 2014. Interim Expert Witness Report - Environmental Sampling in Areas affected by Coal Mining in the Elk and Fording River Watersheds of South Eastern British Columbia. 2012-2014. By Peter K. Krahn, P. Eng., Sr. Enforcement Engineer and National Operational Advisor, Environment Canada Enforcement Division,

> *The mining of coal and the placement of waste rock and overburden has caused partial destruction of most tributary streams in the Upper Fording River that lie within the coal mining operations by direct deposit of the overburden or by the generation of waste rock slides into the drainages. Approximately 5 km of Kilmarnock Creek has been totally destroyed as fish habitat by coal mining due to waste rock slides and the construction of settling ponds. The destruction of Kilmarnock Creek by a coal mining waste rock slide and the construction of downstream settling ponds at the mouth of the creek has removed in excess of 5.0 km of rearing and critical overwintering habitat from the upper Fording River watershed where it had been reported that up to 37% of the trout overwintered. This has forced a large proportion of surviving fish to over winter in the Fording River in a 9 km section known as the Fording River Oxbows which lies adjacent to the Greenhills Operations Coal mine and downstream of the Fording River Operations coal mine.*

Stream Alterations

The Westslope Fisheries 2016 report[11] also noted that stream channel degradation impacts aquatic life health in the upper Fording River.

> *Habitat assessments documented riparian vegetation loss, channel instability and degraded fish habitat conditions such as excessive width: depth ratios, shallow water depths, limited pool habitat (pool area, pool frequency), limited structural elements in the form of large woody debris (LWD), increased gradient and coarser substrates with decreased substrate diversity. These impacts also contribute to increased water temperatures and increased extent and duration of channel dewatering creating migration barriers and a loss of connectivity.*

Macroinvertebrate Health

The Elk Valley Water Quality Plan[12] documented the effects of macroinvertebrate health in mine exposed streams (Table 4-15, pg 4-34 and 4-35). The report noted that out of 56 stream segments in five management units, 20 segments were ranked as having adverse impacts when compared to similar reference streams. Adverse effects were generally reflected as reductions in the combined proportion of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) (i.e., EPT), or the proportion of Ephemeroptera alone.

The 2019 Environmental Monitoring Committee (EMC) report noted that,

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Pacific and Yukon Regional Office. Version Date: 2014-09-25. For Public Prosecution Service of Canada Regulatory and Environmental Crimes.

[11] Westslope Fisheries. 2016. Upper Fording River Westslope Cutthroat Trout Population Assessment and Telemetry Project Final Report Study Period: August 2012 to November 2015. Technical Report Overview prepared for Teck by Westslope Fisheries, Ltd. Accessed on September 15, 2020 at [HYPERLINK "https://www.teck.com/media/Upper-Fording-River-Westslope-Cutthroat-Trout-Population-Assessment-and-Telemetry-Project,-Final-Report-(December-2016).pdf"].

[12] Teck Resources Ltd. 2015. Elk Valley Water Quality Plan. Accessed on September 15, 2020 at https://www.teck.com/media/2015-Water-elk_valley_water_quality_plan_T3.2.3.2.pdf

Of the 46 mine-exposed areas sampled in 2018, five had EPT abundances less than the normal range observed in reference (not mine-exposed) tributaries. Results from 2018 again showed a reduction in the proportion of three types of mayflies in the upper part of the Fording River;

the benthic invertebrate community in Corbin Creek downstream of the Coal Mountain Operations and in Michel Creek displayed reduced numbers of certain species when compared to the reference sites.

Drinking Water

EMC 2019 Report – *Teck offers private well owners in the Elk Valley the opportunity to have their water tested for mining related substances. Well owners along Michel Creek, the Fording River, and the Elk River should be aware that concentrations of some mine-related substances may be elevated, especially when creeks and rivers have low flow. Teck shares the laboratory results with well owners and regulatory agencies, but they are otherwise confidential. The laboratory results are compared to the BC drinking water quality guidelines. If the results are above background levels but below the BC water quality guidelines, Teck will continue to sample the well annually or every three months, depending on the results. If the results are above guidelines for mine-related substances, Teck provides alternate drinking water and continues routine monitoring. In 2018, four of the thirteen wells that were sampled routinely as part of this program had concentrations of selenium temporarily above the BC drinking water guideline of 10 µg/L.*

Calcite

EMC 2019 Report – *Calcite is a common component of sedimentary rock, particularly limestone, and is made up of calcium carbonate – a calcium salt. Calcium carbonate is very common; it is the main building block of animal shells and is the white crust that builds up on the bottom of your tea kettle. As water travels through rock (both underground and on the surface), calcite in the rock dissolves and the calcium carbonate is carried into streams and rivers. Here the calcium carbonate can recrystallize and form a thin layer of calcite on the streambed. This process does occur naturally in streams, but mining operations have the potential to increase the rate, extent, and depth of the formation of calcite when water passes through waste rock piles. When that thin layer of calcite on the streambed builds up over time, it starts to form a calcite crust that can cement gravel and rocks together, degrading habitat for fish and aquatic insects.*

Compliance

2019 Environmental Monitoring Committee Report[13]:

- In 2018, 11.5% of water chemistry samples at compliance points in the Elk River valley exceeded permit limits
    - 24 of 1400 samples taken (1.7%) measured above the B.C. aluminum guideline
    - 79 of 1400 samples taken (5.6%) measured above the B.C. iron guideline
    - 160 of 1400 samples taken (11.4%) measured above the B.C. mercury guideline

[13] Teck Resources Ltd. 2019. Permit 107517 Environmental Monitoring Committee 2019 Public Report. Accessed September 17, 2020 at https://www.teck.com/responsibility/sustainability-topics/water/water-quality-in-the-elk-valley/research-and-monitoring-reports/.

  - 51 of 1400 samples taken (3.6%) measured above the B.C. cobalt guideline
  - 15 of 1400 samples taken (1.1%) measured above the B.C. nitrite guideline
  - 66 of 1400 samples taken (4.7%) measured above the B.C. uranium guideline
- There is an increasing trend in compliance violations from 2016-2018

Misc Compliance

- Line Creek Fish Kill – $1.425 million under the Fisheries Act
- "Over the past five years, the Ministry has issued the proponent with over $600,000 in provincial court convictions, fines and penalties for various environmental violations related to water quality in the Elk Valley," (IAAC, 2020)[14]
- Teck July 2020 Quarterly Financial Statement[15] – *"During the third quarter of 2018, we received notice from Canadian federal prosecutors of potential charges under the Fisheries Act in connection with discharges of selenium and calcite from steelmaking coal mines in the Elk Valley. Since 2014, compliance limits and site performance objectives for selenium and other constituents, as well as requirements to address calcite, in surface water throughout the Elk Valley and in the Koocanusa Reservoir have been established under a regional permit issued by the provincial government, which references the Plan. If federal charges are laid, potential penalties may include fines as well as orders with respect to operational matters. Discussions with respect to the draft charges continue. It is not possible at this time to fully assess the viability of our potential defenses to any charges, or to estimate the potential financial impact on us of any conviction. Nonetheless, that impact may be material."*

In 2020, Teck[16] stated that,

> *There can be no assurance that the water quality targets set out in our valley-wide water quality management plan [the Elk Valley Water Quality Plan] will prove to be suitably protective of the environment, that our planned mitigation efforts will be sufficient to meet those targets or that ongoing monitoring will not disclose unanticipated environmental effects of our operations that will require additional mitigation*

[14] IAAC. 2020. Analysis Report – Whether to Designate the Castle Project in British Columbia Pursuant to the Impact Assessment Act. Impact Assessment Agency of Canada. Accessed on September 16, 2020 at https://iaac-aeic.gc.ca/050/documents/p80702/135794E.pdf.

[15] Teck Resources Ltd. 2020. News Release – Teck Reports Unaudited Second Quarter Results for 2020. Accessed on September 17, 2020 at https://www.teck.com/investors/financial-reports/quarterly-reports/.

[16] Teck Resources Limited, 2019 Annual Information Form (2020), online: https://www.teck.com/media/2020-AIF.pdf